Estimated Costs of Projecting Electric Power onto a Battlefield

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Why is it important to know the cost of battlefield power?

- Want to know whether power costs are a significant cost of warfighting
- Want to know the gains from improved power efficiency
- Want to know the main drivers of power costs
- Want to be able to compare various power technologies against one another

Today's Talk

- A look at costs of power from generators
  - Describe operating scenario
  - Identify generator cost components
  - Estimate costs for the given scenario and unit
  - Estimate total cost per kilowatt hour
  - Develop implications and draw conclusions

Assumed Scenario

- Location 8700 miles from U.S.
- First 30 days:
  - On move 2 hrs/day
  - Cover 30 miles/day
  - Export power 8 hrs/day
- Rest of 1 year:
  - Hold fixed positions
  - Export power 16 hrs/day
- Total power export time: 5600 hours

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Implications of Scenario

- Need to move power source to the battlefield
- Need to move it on the battlefield
- Need fuel for power

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Generators for a Stryker Brigade Combat Team

- 146 generators
- 2 KW – 60 KW capacity range
- 15 KW & above are trailer mounted
- 1077 KW total
- 12 maintenance personnel

Generator Cost Components

- Generator depreciation
- Maintenance
- Fuel
- Personnel
- Transport on battlefield
- Transport to battlefield

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Depreciation

- Total cost of 146 gen-sets: $1.7M*
- Expected gen-set lifetime: 6375 hours
- Depreciation rate: $269/hr
- Total cost (5600 hours) $1.5M

*Sources: TO&E for an SBCT; U.S. Army gen-set operating manuals

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Maintenance

- Annual maintenance cost: $98K*
  (146 gen-sets)
- Assumed annual use 375 hrs
- Hourly cost $261/hr
- Total (5600 hrs) $1.5M

*Source: TEP ORD of Nov. 2003

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Fuel

- Hourly fuel use 109 gallons
- Per gallon cost $13/gal*
- Hourly cost $1417
- Total cost (5600 hours) $7.9M

*Source: DSB Study, “More Capable Warfighting Through Reduced Fuel Burden,” 2001

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Support Personnel

- Direct within SBCT 12
- SBCT indirect (1:6) 2
- Combat service support (1:2) 7
- Non-deployable support (1:2) 10
- Total hourly cost* $724/hr
- Total cost $6.3M

*Directs costed as E-3s, indirect at all-Army average.

Transport on the Battlefield

- Weight of 2-10 KW gen-sets 61,900lbs
- No. of trucks needed 25 2.5-ton
- Transport time 60 hrs
- Depreciation + fuel cost/truck $48/hr
- Total cost $72K

Transport to the Battlefield (8700 miles)

- Air $834K
- Sea $17K
- Pre-position 500 miles from battlefield $95K

Total Costs of Power

- Depreciation $1.5M
- Maintenance $1.5M
- Fuel $7.9M
- Support personnel $6.3M
- Transport on battlefield $0.1M
- Transport to battlefield $.1-.8M
- **TOTAL COST $17.4-18.1M**

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Cost per KWH

- Total cost: $17.4-18.1M
- Total KWH capacity 6,031,200 KWH
  (5600 hrs x 1077KW)
- Cost per KWH $2.90 - $3.00

  - Cost of gen-set power in the U.S. $.40/KWH
  - Cost of grid power in the U.S. $.085/KWH

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Drivers of SBCT Gen-set Costs

- Fuel + personnel cost = $14.2M
- Equals about 80% of total costs of power
- Greatest opportunities for improvement appear to be gen-set fuel efficiency, maintainability

Conclusions

- Gen-set power on battlefield is expensive relative to gen-set or grid power within U.S.
- Other power export technologies can be compared
  - Hybrid electric vehicles
  - Under the Hood power
  - Auxiliary Power Units
  - Fuel cells
- Fuel & support personnel appear to be the main gen-set cost drivers
- More fuel efficient, higher MTBF gen-set capability could significantly reduce their power costs

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